In the Claims:

1-285 (Canceled).

286. (New) A radiofrequency (RF) resonator for magnetic resonance analysis, the RF resonator comprising:

(a) at least two conductive elements, each having a first curvature along a direction perpendicular to a longitudinal axis, said at least two conductive elements being spaced along said longitudinal axis, so that when an RF current flows within said at least two conductive elements in a direction of said longitudinal axis, a substantially homogenous RF magnetic field, directed perpendicular to said longitudinal axis, is produced in a volume defined between said at least two conductive elements; and

(b) an electronic circuitry designed and configured for providing predetermined resonance characteristics of the RF resonator, for matching an impedance of the RF resonator to an impedance of an RF transmitter electrically communicating with said electronic circuitry, and for balancing said RF magnetic field to have a substantially symmetrical profile with respect to a transverse axis being perpendicular to said longitudinal axis.

287. (New) The RF resonator of claim 286, further comprising at least one additional conductive element positioned so as to further minimize inhomogeneity of said magnetic field.

288. (New) The RF resonator of claim 287, wherein a phase of an RF current flowing through said at least one additional conductive element equals a phase of said RF currents flowing through said at least two conductive elements.

289. (New) A method of designing a radiofrequency (RF) resonator for magnetic resonance analysis, the method comprising:

(a) selecting at least two surfaces to engage at least two conductive elements, said at least two surfaces having a first curvature along a direction

perpendicular to a longitudinal axis, thereby defining a geometry between said at least two surfaces;

(b) using said geometry for calculating a magnetic field within said geometry;

(c) iteratively repeating said steps (a) and (b) so as to provide optimized geometry corresponding to a substantially homogenous magnetic field; and

(d) using said optimized geometry and said substantially homogenous magnetic field for designing an electronic circuitry for providing predetermined resonance characteristics of the RF resonator, for matching an impedance of the RF resonator to an impedance of an RF transmitter electrically communicating with said electronic circuitry, and for balancing said RF magnetic field to have a substantially symmetrical profile with respect to a transverse axis being perpendicular to said longitudinal axis.

290. (New) The method of claim 289, wherein said matching is by varying mutual capacitance.

291. (New) The method of claim 289, wherein said matching is by varying mutual inductance.

292. (New) The method of claim 289, further comprising designing an RF shield for minimizing electromagnetic interactions between the RF resonator and at least one gradient coil and/or between the RF resonator and a device for providing a static magnetic field.

293. (New) The method of claim 289, further comprising designing at least one end-cap to be positioned adjacent to at least one end of the RF resonator for minimizing magnetic field inhomogeneities along said longitudinal axis.

294. (New) The method of claim 289, further comprising designing at least one additional conductive element, so as to further minimize inhomogeneity of said magnetic field.

295. (New) The method of claim 294, wherein a phase of an RF current flowing through said at least one additional conductive element equals a phase of currents flowing through said at least two conductive elements.

296. (New) An apparatus for magnetic resonance analysis, the apparatus comprising:

(a) a device for providing a static magnetic field;

(b) a processing unit; and

(c) a radiofrequency (RF) resonator coupled to an RF transmitter, said RF resonator comprising:

at least two conductive elements, each having a first curvature along a direction perpendicular to a longitudinal axis, said at least two conductive elements being spaced along said longitudinal axis, so that when an RF current flows within said at least two conductive elements in a direction of said longitudinal axis, a substantially homogenous RF magnetic field, directed perpendicular to said longitudinal axis, is produced in a volume defined between said at least two conductive elements; and

an electronic circuitry designed and configured for providing predetermined resonance characteristics of said RF resonator, for matching an impedance of said RF resonator to an impedance of said RF transmitter, and for balancing said RF magnetic field to have a substantially symmetrical profile with respect to a transverse axis being perpendicular to said longitudinal axis.

297. (New) The apparatus of claim 296, wherein said RF resonator further comprising at least one additional conductive element positioned so as to further minimize inhomogeneity of said magnetic field.

298. (New) The apparatus of claim 297, wherein a phase of an RF current flowing through said at least one additional conductive element equals a phase of said RF currents flowing through said at least two conductive elements.

299. (New) The apparatus of claim 296, wherein said device for providing said static magnetic field comprises at least one shim coil.

300. (New) The apparatus of claim 296, further comprising at least one end-cap positioned adjacent to at least one end of said RF resonator, said at least one end-cap constructed and designed for minimizing magnetic field inhomogeneities along said longitudinal axis.

301. (New) The apparatus of claim 296, wherein said RF resonator is a multi frequency RF resonator.

302. (New) The apparatus of claim 296, wherein each of said at least two conductive elements has a predetermined capacitance distribution for minimizing effects of an object to be imaged on said magnetic field and for minimizing corona discharge from said at least two conductive elements.

303. (New) A method for Magnetic Resonance analysis of an object, the method comprising:

applying a static magnetic field on the subject in a direction of a longitudinal axis;

applying a substantially homogenous radiofrequency (RF) magnetic field on the subject, in a direction perpendicular to said longitudinal axis; and

acquiring nuclear magnetic resonance parameters from the object, thereby analyzing the object;

wherein said applying said substantially homogenous RF magnetic field is by a RF resonator coupled to an RF transmitter, said RF resonator comprising:

at least two conductive elements, each having a first curvature along a direction perpendicular to said longitudinal axis, said at least two conductive elements being spaced along said longitudinal axis, so that when an RF current flows within said at least two conductive elements in a direction of said longitudinal axis, said substantially homogenous RF magnetic field, is produced in a volume defined between said at least two conductive elements; and

an electronic circuitry designed and configured for providing predetermined resonance characteristics of the RF resonator, for matching an impedance of the RF resonator to an impedance of an RF transmitter electrically communicating with said electronic circuitry, and for balancing said RF magnetic field to have a substantially

symmetrical profile with respect to a transverse axis being perpendicular to said longitudinal axis.

304. (New) The method of claim 286, further comprising balancing said RF magnetic field using a balancing adjuster electrically communicating with said electronic circuitry.

305. (New) The method of claim 303, wherein said RF resonator further comprising at least one additional conductive element positioned so as to further minimize inhomogeneity of said magnetic field.

306. (New) The method of claim 305, wherein a phase of an RF current flowing through said at least one additional conductive element equals a phase of said RF current flowing through said at least two conductive elements.

307. (New) The method of claim 303, wherein the object is selected from the group consisting of a mammal, an organ of a mammal, a tissue, a swollen elastomer and a food material.

308. (New) The method of claim 303, wherein said applying said substantially homogenous RF magnetic field is by at least one additional RF resonator.

309. (New) The method of claim 308, further comprising electrically decoupling said RF resonator from said at least one additional RF resonator.

310. (New) The method of claim 308, further comprising electromagnetically decoupling said RF resonator from said at least one additional RF resonator.

311. (New) The method of claim 303, wherein said RF resonator is a multi frequency RF resonator.

312. (New) The method of claim 303, wherein each of said at least two conductive elements has a predetermined capacitance distribution for minimizing

effects of the object on said magnetic field and for minimizing corona discharge from said at least two conductive elements.

313. (New) A radiofrequency (RF) resonator for magnetic resonance analysis, the RF resonator comprising:

(a) at least two conductive elements, each having a first curvature along a direction perpendicular to a longitudinal axis, said at least two conductive elements being spaced along said longitudinal axis, so that when an RF current flows within said at least two conductive elements in a direction of said longitudinal axis, a substantially homogenous RF magnetic field, directed perpendicular to said longitudinal axis, is produced in a volume defined between said at least two conductive elements; and

(b) at least one additional conductive element, electrically communicating with said at least two conductive elements in a manner such that a phase of an RF current flowing through said at least one additional conductive element equals a phase of at least one of said RF currents flowing through said at least two conductive elements.

314. (New) The RF resonator of claim 313, further comprising an electronic circuitry designed and configured for providing predetermined resonance characteristics of the RF resonator, for matching an impedance of the RF resonator to an impedance of an RF transmitter electrically communicating with said electronic circuitry, and for balancing said RF magnetic field to have a substantially symmetrical profile with respect to a transverse axis being perpendicular to said longitudinal axis.

315. (New) An apparatus for magnetic resonance analysis, the apparatus comprising:

(a) a device for providing a static magnetic field;

(b) a processing unit; and

(c) a radiofrequency (RF) resonator coupled to an RF transmitter, said RF resonator comprising:

at least two conductive elements, each having a first curvature along a direction perpendicular to a longitudinal axis, said at least two conductive elements being spaced along said longitudinal axis, so that when an RF current flows within

said at least two conductive elements in a direction of said longitudinal axis, a substantially homogenous RF magnetic field, directed perpendicular to said longitudinal axis, is produced in a volume defined between said at least two conductive elements; and

at least one additional conductive element, electrically communicating with said at least two conductive elements in a manner such that a phase of an RF current flowing through said at least one additional conductive element equals a phase of at least one of said RF currents flowing through said at least two conductive elements.

316. (New) The apparatus of claim 315, wherein said RF resonator further comprising an electronic circuitry designed and configured for providing predetermined resonance characteristics of said RF resonator, for matching an impedance of said RF resonator to an impedance of said RF transmitter, and for balancing said RF magnetic field to have a substantially symmetrical profile with respect to a transverse axis being perpendicular to said longitudinal axis.

317. (New) The apparatus of claim 316, wherein said RF resonator further comprising a balancing adjuster electrically communicating with said electronic circuitry, said balancing adjuster is constructed and designed for controlling said electronic circuitry while said RF resonator is in medical use.

318. (New) The apparatus of claim 315, wherein said device for providing said static magnetic field comprises at least one shim coil.

319. (New) The apparatus of claim 315, further comprising at least one gradient coil.

320. The apparatus of claim 315, further comprising at least one end-cap positioned adjacent to at least one end of said RF resonator, said at least one end-cap constructed and designed for minimizing magnetic field inhomogeneities along said longitudinal axis.

321. (New) The apparatus of claim 316, wherein said electronic circuitry comprises means for varying mutual capacitance.

322. (New) The apparatus of claim 316, wherein said electronic circuitry comprises means for varying mutual inductance.

323. (New) The apparatus of claim 322, wherein said mutual inductance is defined between said RF resonator and said RF transmitter.

324. (New) The apparatus of claim 322, wherein said mutual inductance is defined between said electronic circuitry and said RF transmitter.

325. (New) The apparatus of claim 315, wherein a longitudinal dimension of said at least two conductive elements is selected so as to minimize magnetic field inhomogeneities along said longitudinal axis.

326. (New) The apparatus of claim 315, wherein a separation between said at least two conductive elements is selected so as to surround an object to be imaged.

327. (New) The apparatus of claim 326, wherein said object is a mammal, an organ of a mammal, a tissue, a swollen elastomer, a food material, a liquid, and at least one type of molecules present in the solvent.

328. (New) The apparatus of claim 315, wherein at least one of said at least two conductive elements further has a second curvature along a direction parallel to said longitudinal axis.

329. (New) The apparatus of claim 315, wherein a number of said at least two conductive elements is selected so that said substantially homogenous RF magnetic field is linearly polarized.

330. (New) The apparatus of claim 315, wherein a number of said at least two conductive elements is selected so that said substantially homogenous RF magnetic field is substantially circularly polarized.

331. (New) The apparatus of claim 315, wherein said at least two conductive elements are two conductive elements.

332. (New) The apparatus of claim 315, wherein said at least two conductive elements are four conductive elements.

333. (New) The apparatus of claim 332, wherein a first pair of said four conductive elements is electrically decoupled from a second pair of said four conductive elements.

334. (New) The apparatus of claim 332, wherein a first pair of said four conductive elements is magnetically decoupled from a second pair of said four conductive elements.

335. (New) The apparatus of claim 332, wherein a first pair of said four conductive elements is electrically decoupled from a second pair of said four conductive elements.

336. (New) The apparatus of claim 332, wherein a first pair of said four conductive elements is electromagnetically decoupled from a second pair of said four conductive elements.

337. (New) The apparatus of claim 332, wherein a first pair and a second pair of said four conductive elements are positioned so that a transverse axis of said first pair is substantially perpendicular to a transverse axis of said second pair.

338. (New) The apparatus of claim 315, wherein said at least two conductive elements are made of a superconducting material.

339. (New) The apparatus of claim 338, further comprising means for preserving said at least two conductive elements at a sufficiently low temperature.

340. (New) The apparatus of claim 338, further comprising at least one additional RF resonator arranged with said RF resonator to form an RF resonator array.

341. (New) The apparatus of claim 340, further comprising decoupling means for decoupling said RF resonator from said at least one additional RF resonator.

342. (New) The apparatus of claim 319, further comprising decoupling means for decoupling said RF resonator from said at least one gradient coil.

343. (New) The apparatus of claim 340, wherein said array is a phased array.

344. (New) The apparatus of claim 338, wherein said RF resonator is a multi frequency RF resonator.

345. (New) The apparatus of claim 338, wherein each of said at least two conductive elements has a predetermined capacitance distribution for minimizing effects of an object to be imaged on said magnetic field and for minimizing corona discharge from said at least two conductive elements.

346. (New) The apparatus of claim 315, wherein said at least two conductive elements are designed and constructed to minimize eddy currents generated therein.

347. (New) The apparatus of claim 315, wherein said at least two conductive elements are characterized by an RF shield structure for substantially blocking RF radiation while transmitting low frequency radiation.